discusses 160 observations of the peculiar variable RV Tauri (45, 1905). The light-curve of this object is of the β Lyræ type, and the maxima and secondary minima present variations in amplitude which appear to be irregular. Between November, 1904, and July, 1905, the character of the variation seems to have altered completely, while further observations made at the Laws Observatory during 1906 and 1907 indicate that the curve has again changed its form. This object then presents an unsolved problem similar to that presented in the cases of R Sagittæ and V Vulpeculæ.

PHOTOMETRIC OBSERVATIONS OF SHORT-PERIOD VARIABLE STARS.—No. 4247 of the *Astronomische Nachrichten* (p. 369, May 8) contains a series of results of the observations of twenty-nine variable stars of short period obtained by Herr H. v. Zeipel at the Upsala Observatory during 1907. For each star two comparison stars were employed, and their positions and magnitudes are given at the head of each table.

THE RELATIVE ACCURACY OF VARIOUS DOUBLE-STAR OBSERVERS.—A short paper by Herr V. Ehrenfeucht, appearing in No. 4247 of the *Astronomische Nachrichten* (p. 381, May 8), deals with the relative accuracy of the principal double-star observers. The resulting figures were obtained by comparing the measures of these observers with the ephemerides of fifty-two well-known doubles, and the probable errors in position-angle and distance are given for eleven observers. The errors in distance range from 0″·055, for Schiaparelli, to 0″·100, for Mädler, the mean value for all the observers considered being 0″·698.

ITALIAN OBSERVATIONS OF THE SUN DURING 1907.—The usual summary, by Prof. Riccò, of the observations of spots, faculæ, and prominences made at Catania during last year, appears in No. 3, vol. xxxvii., of the *Memorie della Società degli Spettroscopisti Italiani*.

The present paper deals especially with the second semestre of 1907, but the values for the whole year are given. For the period July to December the mean daily frequencies of spots, faculæ, and prominences were 5·7, 2·1, and 4·7 respectively, whilst for the whole year the corresponding values were 5·5, 3·4, and 4·3.

THE NATAL OBSERVATORY.—Mr. Nevill's report of the work done at the Natal Observatory during 1907 is, as usual, chiefly devoted to the meteorological results obtained at the various meteorological stations of the colony. The only astronomical note of general interest is that a series of observations of comet 1907*d* was made by Mr. A. E. Hodgson, and the results are to be communicated to the Royal Astronomical Society. The magnetic declination at Durban for January 1, 1908, is given as 22° 27′ W., with a yearly decrease of 12′, and the present value of the dip is 63°·2.

SOLAR PHENOMENA AND TERRESTRIAL TEMPERATURES.—In a paper published in the *Bulletin de la Société astronomique de France* for May, Dr. J. Loisel discusses the relationships between the activity of various solar phenomena and the amount of heat received at the earth's surface. The results are based on the observations made at Montpellier during the period 1883–1901, and are of such interest as to suggest the desirability of prosecuting this research in many more different localities. Plotting the actinometric results obtained at Montpellier, together with the frequency curves for sun-spots, faculæ, and prominences, Dr. Loisel shows that they are distinctly analogous, but the terrestrial variation is an inversion of the solar variations.

THE OKAPI MONOGRAPH.[1]

SHORTLY after the arrival in London of the first complete skin of the okapi, the administration of the Congo Free State at Brussels sent urgent orders to its officials on the Uganda border to procure other skins, and also skeletons, of the then newly discovered animal. In due course these orders were carried out, and a representative series of specimens received at the Museum of the Free State at Tervueren, a few miles out of Brussels, some of which were mounted for public exhibition, while others were reserved for study. With commendable promptitude, the administration thereupon took steps to arrange for a monograph of the okapi, the preparation of which was entrusted in 1902 to Dr. Forsyth Major, who had already made a special study of the giraffe group.

During the same year, that gentleman visited Belgium for the purpose of studying the Tervueren specimens, upon which he published several preliminary notes in *La Belgique Coloniale*. Coloured and other plates for the monograph were also prepared under his direction. Nevertheless, after something like two years' delay, no MS. was forthcoming, and the Secretary of the Free State felt himself compelled to seek another author. Accordingly, Prof. Julien Fraipont was approached, who, after some demur, eventually consented, at the close of 1905, to undertake the work, and to use, so far as practicable, the plates prepared under Dr. Major's direction.

The result of these negotiations is the present elaborate and richly illustrated monograph, which bears on every page testimony to the author's diligence and industry. In one respect the delay has been of very considerable advantage, since it has admitted of the examination and comparison of a much larger series of specimens than was available in 1902–3. Most of these, it should be mentioned, originally belonged to the authorities of the Free State, by whom examples have been presented to the museums of Stockholm, Lisbon, Paris, Madrid, and Antwerp. Altogether, the author had at his disposal no fewer than a dozen skins, seven skeletons, and eleven skulls. With such full material, the monograph could scarcely fail to be otherwise than in a great degree exhaustive.

Following the usual rule, the monograph opens with a historical sketch of the discovery of the okapi and the subsequent acquisition of fuller knowledge of its structure and affinities. In the course of this chapter the author discusses the identification of the okapi with "Set-Typhon" of the ancient Egyptian frescoes and sculptures—an identification which he refuses to admit. The idea is, however, by no means dead, a special work on the subject having been published in Paris last year.

The next chapter is devoted to the general external form and colouring of the creature, in the course of which the author expresses his opinion that, if we except the zebra-like pattern on the limbs and the general brilliance of tone (rather a large order, by the way), the coloration is not unlike that of many antelopes. Of great interest are a number of figures of the limbs of different individuals to display individual variation in the matter of colour-pattern. The skeleton forms the subject of the following chapter, in the course of which the author devotes particular attention to the nature of the horns of the giraffe and okapi, and their correspondence with those of other ruminants. The "vellericorn," or skin-covered, type presented by the former is evidently the most primitive, and there can be equally little doubt that the cap of bare bone at the tip of the okapi's horn represents the deer's antler. A further inference from the latter identification is that the shedding of the antlers in deer is an acquired character, and it is noteworthy that some Tertiary stags seem to have permanent antlers, while in several of the less specialised living species, such as the Indian sambar, the shedding does not take place annually. Front views of a male and a female skull are given, although little is said with regard to individual variation in skull-width, of which we believe there is a good deal. In mentioning the existence of a double bicipital groove to the humerus, the author scarcely gives sufficient emphasis to the fact that this feature is absolutely distinctive of the Giraffidæ.

With regard to the habits of the okapi, Prof. Fraipont has, of course, nothing new to relate, but the photographs he gives of the equatorial forest seem to confirm the suggestion that the striping of the limbs and hind-quarters serves the purpose of breaking up the outline of the creature in the comparatively clear basal zone of the forest. Copious extracts are given from the writings of those who have obtained more or less nearly accurate information with regard to the okapi's haunts and mode of life.

A casual survey of the four coloured plates included among the illustrations will probably lead to the belief

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[1] "Contribution à la Faune du Congo." Vol. i., Okapia. By Julien Fraipont. Pp. 118; 38 plates. *Annales du Musée du Congo*. Zoologie, ser. 2. (Brussels, 1907.)

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that the author recognises two species of okapi, as two of the plates are lettered *Okapia liebrechtsi.* This is due, however, to the fact that Prof. Fraipont had to use the plates prepared for Dr. Major, and from the descriptions of the plates we learn that the author recognises only a single species—the typical *O. johnstoni.* In this we think he is certainly right, and that some other factor than specific distinction will have to be sought to explain the differences between individual okapis in the matter both of colour-pattern and of skull-characters. If there be two kinds, the okapi certainly forms a strange exception to the law of "geminal species."

Both the author and the administration of the Congo Free State are to be congratulated on this handsome and exhaustive monograph. R. L.

IRON AND STEEL INSTITUTE.

THE annual meeting of the Iron and Steel Institute was held in London at the Institution of Civil Engineers on May 14 and 15, and was largely attended by members from the various iron-producing districts of this country and abroad. Sir Hugh Bell presided.

The report of the council, read by Mr. Bennett H. Brough, the secretary, showed that the institute had made considerable progress during the year 1907. The membership amounted to 2100, and the financial prosperity was a matter for congratulation. In presenting the accounts, Mr. W. H. Bleckly, hon. treasurer, announced that Mr. Andrew Carnegie, past-president, had presented to the research fund the further sum of eleven thousand dollars, bringing his total benefaction to one hundred thousand dollars. In moving the adoption of these reports, the president announced that the institute had secured larger premises in the same building as those previously occupied, and that the reading-room accommodation had been much improved.

The president then handed the Bessemer gold medal to Mr. B. Talbot, inventor of the continuous open-hearth steel process, who expressed his acknowledgments.

The first paper read described improvements in plate-rolling mills. In it Mr. A. Lamberton described a new form of plate-mill now successfully at work at the Glasgow Iron and Steel Works for rolling light plates. The paper, on the physical qualities of steel in relation to its mechanical treatment, contributed by Mr. James E. York (New York) contained suggestions for changes that might result in the production of more trustworthy rails and other similar sections than those now produced by ordinary methods. The heating of the ingots is a matter of great importance, and it is recommended that the finishing temperature should be as low as possible to get the best results, and that the initial temperature should not exceed 950° C. For solidifying ingots the author's method of transverse rolling may be applied.

Dr. T. E. Stanton, of the National Physical Laboratory, described a new fatigue test for iron and steel, in which a combination of rolling abrasion and alternate bending is used. The machine designed for the purpose was exhibited and described.

Prof. B. Igewsky (Kieff) submitted a paper describing a small electric furnace of novel design erected for experimental purposes at the Kieff Polytechnic Institute. It is a rotating cylindrical furnace, with its axis horizontal, built up of fire-brick blocks with contact pieces rubbing against the outside surface. Most of the heating is done by the passage of the current through the inner surfaces of the refractory material, which, when red hot, becomes a conductor. A continuous current of 250 volts and 50 amperes is employed. Experiments for the production of steel from cast iron by the ore process were successful.

The meeting was then adjourned until May 15, when the first paper was read by Mr. F. J. R. Carulla (Derby), who directed attention to the difficulty in finding cast iron suitable for use in the construction of chemical plant. For some purposes, as, for example, ammonia stills, cast iron seems everlasting, and even acid chemicals have sometimes little action on cast iron. Yet when hydrochloric acid is in question, cast iron succumbs like any weaker vessel.

It was announced that the council had awarded Carnegie research scholarships, each of the value of 100*l.*, to T. Baker (South Wales), R. F. Böhler (New York), W. Giesen (Mexico), E. Preuss (Germany), and L. P. M. Révillon (France). The president then handed the Carnegie gold medal for research to Dr. Carl Benedicks, of Upsala University, and stated that the reports submitted by the eight holders of research scholarships were considered to be of sufficient merit to warrant their publication in the journal of the institute.

Mr. E. F. Law exhibited some striking lantern photographs illustrating the application of colour photography to metallography. With the aid of Lumière's autochrome plates it is possible to obtain a photograph in colour on a single plate and by a single exposure. In order to distinguish the constituents, the polished specimen of an alloy is heated until a film of oxide forms on the surface. Owing to the different rates at which the constituents oxidise, they assume different colours, and can be readily distinguished in the coloured photograph.

The utilisation of blast-furnace slag formed the subject of a paper read by Mr. C. de Schwarz (Liége), in which he reviewed recent processes for making slag bricks and cement. Blast-furnace works, especially those producing grey pig iron, have evidently still a large field for improvement by utilising their slag for such purposes.

Mr. Walter Rosenhain gave a detailed description of the metallurgical and chemical laboratories in the National Physical Laboratory, and Mr. Wesley Lambert gave an interesting account of the pyrometric installation in the gun section of the Royal Gun and Carriage Factories, Woolwich.

The eight reports on research work submitted by holders of Carnegie research scholarships showed that a large amount of very valuable work is resulting from the funds placed at the disposal of the institute by Mr. Carnegie. The investigation described by Mr. E. Hess (New York) was carried out at a plant at Monterrey, Mexico, its object being to ascertain the microscopical structures of steels the carbon content of which is above 0·9 per cent. at various temperatures above the critical point. The rusting of iron was dealt with by Mr. J. Newton Friend (Suffolk), whose results point to the fact that the rusting of iron is primarily the result of acid attack. The object of the research described by Mr. D. M. Levy (Birmingham) was to investigate the influence of sulphur, as it affected the relations of carbon and iron, and by a series of coordinated thermal, mechanical, chemical, and microscopic tests to determine how far this action could be traced to any combination or reaction between these three elements, or what explanation could be elicited for it.

No evidence was found to support the view that chemical union between iron, carbon, and sulphur is the cause of sulphur tending to retain carbon in the combined form in irons. The purely physical—or rather mechanical—effects of the sulphide observed in the research appear to offer a satisfactory explanation of its action, exercised even by very small proportions.

Mr. A. Hiorth (Christiania) gave the preliminary results of trials in refining iron and steel by means of vapours of metallic sodium. He finds that iron treated in this way is more fusible and will remain molten longer than other iron, and that such treatment will remove the oxygen. The research submitted by Mr. B. Saklatwalla (Charlottenburg) on the constitution of iron and phosphorus compounds was made with the view of supplementing Stead's chemical researches by a complete thermal and metallographic investigation of the subject. The function of chromium and tungsten in high-speed tool steel was investigated by Mr. C. A. Edwards (Manchester); and Mr. H. C. Boynton (New Jersey) submitted a continuation of his researches on the hardness of the constituents of iron and steel.

Lastly, Dr. Carl Benedicks (Upsala), in a memoir for which the Carnegie gold medal was awarded, gave the results of experimental researches on the cooling power of liquids, on quenching velocities, and on the constituents troostite and austenite. He finds that the essential condition for a quenching liquid to give effective cooling appears to be a high latent heat of vapour, and so low a temperature that the vapour bubbles formed at the surface of the metal may be easily condensed in the surrounding liquid. The rate of flow of the liquid has very little in-

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